Geophysical Research Abstracts,
Vol. 11, EGU2009-9952, 2009
EGU General Assembly 2009

Mass variations of the Baltic Sea compared to superconducting gravimeter and GRACE

H. Virtanen, J. Virtanen, M. Nordman, M. Bilker-Koivula, and J. Mäkinen

Finnish Geodetic Institute, Geodesy and Geodynamics, Masala, Finland (heikki.virtanen@fgi.fi, 358 9 29555200)

We study the gravity effect of Baltic Sea mass variations observed using different methods and time resolutions. We compare data from tide gauges, from superconductive gravimeter (SG) at Metsähovi, Finland and from the GRACE gravity satellite. The mass variation in the semi-enclosed Baltic Sea is due to both internal redistribution of the water mass and due to changes in the so-called fill level caused by water exchange with the North Sea. The monthly variation in the water mass is about 60 Gt over an area of 390000 km-2. Due to a dense network of tide gauges, the Baltic Sea is one of best monitored mass variations in this size in the world. For modeling the observed water mass, we have used both monthly PSMSL tide gauge records and hourly values from several sources. In addition, we have hydrodynamic models for comparisons. To calculate gravity effect, we have used Green's function formalism for modeled sea surface.

We have previously used temporal gravity field data from GRACE satellite to show that GRACE can recover the total mass variation in the Baltic Sea on monthly scales. In addition to monthly GRACE solutions with different filters, we now also use 10-day mascon block solutions from Goddard Space Flight Center. As the GRACE solutions are already corrected for gravity changes due to oceans, we have restored the contribution due to the Baltic Sea. We have also corrected for an effect due to leakage of continental water storage using the GLDAS hydrology model.

The fundamental station Metsähovi is located 10 km from the nearest bay of the Baltic Sea and 15 km from the open sea. Using a single tide gauge at the distance of 30 km from SG at Metsähovi, very clear correlation is found between gravity and sea level. Superconducting gravity data has been corrected by tides and polar motion, atmospheric mass redistribution, local groundwater and drift. Hourly mass variations of sea are clearly separable. Theoretically one-meter even-layer water cause 30 nms-2 gravity effect in SG, which resolution is better than 1 nms-2. For comparisons to GRACE, we have averaged gravity data to 10 days and monthly values.

Different methods and time scales used show that gravity data from both GRACE and SG can well recover mass variations of the Baltic Sea.

Acknowledgements: FMI, SMHI, DMI, BAFG, ESEAS, BOOS